DRDO NEWSLETTER

A Monthly Bulletin of Defence Research and Development Organisation

www.drdo.gov.in

NOVEMBER 2016 | VOLUME 36 | ISSUE 11

BANG ON

NAG HITS BULL'S EYE IN FINAL DEVELOPMENTAL TRIALS

Nag, the third generation fire-and-forget anti-tank missile developed by the DRDO, scored a "bull's eye" successfully hitting targets in the final developmental trials held last month.

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28th BRIG SK MAZUMDAR MEMORIAL ORATION

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HOW DRDO IS KEEPING INDIAN AIR FORCE MEN AND MATERIAL SAFE

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HONORARY DOCTORATE TO DRDO CHIEF DR S CHRISTOPHER

सत्यमेव जयते

राष्ट्रपति
भारत गणतंत्र
PRESIDENT
REPUBLIC OF INDIA

September 20, 2016

Dear Dr. Christopher,

I extend hearty congratulations to you and all those associated with the successful test-firing of the Surface to Air Missile – 'Barak-8' developed jointly with Israel.

The nation is proud of this achievement. I am sure that this success will further boost India's defence capabilities in technologically challenging areas.

Kindly convey my greetings and felicitations to all members of the team of scientists, engineers, and others involved in this Mission.

With regards,

Yours sincerely,

(Pranab Mukherjee)

Dr. S. Christopher,
Secretary, Department of Defence Research & Development &
Director General, DRDO
Room No. 531, DRDO Bhawan,
Rajaji Marg, NEW DELHI – 110 011.

FROM THE DESK OF THE CHAIRMAN

Dr. S. Christopher

SECRETARY
Department of Defence Research and Development
&
CHAIRMAN
Defence Research and Development Organisation (DRDO)

Every thought we think is creating our future. Imagine the thoughts in our organization emanating each day, with members in different geographical locations, portfolios, labs, work centres and age groups. The synergy in our thoughts can create a formidable future for DRDO. The website and news letter can be the platforms to channelize the synergy and I am sanguine that every member, irrespective of his stature, would make use of it for showing the way forward.

Being an R&D organization, scientists are our strength and I, for one, have always, vouched for the need to keep our younger colleagues motivated, and provide them with enough avenues to display their scientific temper. I am sure that every lab is doing its bit to nurture the young scientists and provide them with the necessary directions to bring their talents to the limelight. One recent initiative in this line is the introduction of a featured article by young scientists in the DRDO web news.

I exhort all my younger colleagues to come out and share their R&D findings in the form of a short article towards this venture. Over a period of time, we will all get to know about some of the exciting scientific work being done in our labs and work centres by the younger members of our fraternity. This will add more value to the DRDO website also, which has been in the recent past, embellished with photographs of the major events that have happened.

At a time when environment concerns are becoming a major point of discussion in all arenas, it is imperative that we at DRDO too contribute towards a greener ambience. It is with this aim that I have decided to make tree plantations a part of every major event that I conduct or participate, be it at the labs or otherwise. I hope that my colleagues at all levels will follow suit. Moving a step further, friends, we must understand that one ton paper is made by cutting 12 trees. Can we reduce the use of paper and save our environment? It would be akin to planting new trees.

Friends, today the country is looking at brand 'DRDO' with lot of hope, faith and we have to face this challenge and scale higher peaks. Let us honour our commitments with integrity and contribute to a stronger and self – reliant nation.

Jai Hind

Defence Research & Development Organisation

NOVEMBER 2016 | VOLUME 36 | ISSUE 11

ISSN: 0971-4391

BROUGHT OUT BY: DPI, DRDO HQ
PRINTED BY: DESIDOC, DELHI

Website: www.drdo.gov.in
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ISSN: 0971-4391

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REMEMBERING THE PEOPLE'S PRESIDENT, BHARAT RATNA DR APJ ABDUL KALAM

DRDO PAYS GLOWING TRIBUTE TO THE MISSILE MAN ON HIS 85th BIRTH ANNIVERSARY

Defence Research & Development Organisation (DRDO) paid rich tribute to Former President of India and former DRDO Chief, Dr A.P.J. Abdul Kalam on his 85th Birth Anniversary at a gala function held in Kothari Auditorium at DRDO Bhawan on 15 October.

For the first time, students from various schools of Delhi were also invited at DRDO Bhawan on this occasion. The purpose was to motivate the children with the diverse and great qualities of Dr A.P.J. Abdul Kalam, who had special affinity for children and youth of the country. Young scientists from various DRDO labs were also invited for the event.

Dr Kalam was DRDO Chief during 1992-1999 and provided the much needed thrust for strengthening self-reliance in defence systems by progressing multiple technology development activities and mission mode projects besides DRDO spin-offs for societal applications.

Dr W Selvamurthy, former Chief Controller of DRDO and a renowned scientist graced the occasion as the Chief Guest. Shri GS Malik, Distinguished Scientist & Chief Controller at DRDO delivered the welcome address where he remembered Dr Kalam who gave the Mantra of self-reliance in Defence Technology.

Dr Manas K Mandal, Distinguished Scientist & Director General (Life Sciences) at DRDO described Dr Kalam as a leader who was born to bring the change in his address. He also motivated the audience particularly students to make consistent effort towards innovation.

> If you want to shine like a sun, first burn like a sun.
> - *Dr APJ Abdul Kalam*

Dr Selvamurthy in his address reminisced the days of his association with Dr Kalam in DRDO, and termed him as a Personality- easy to admire, difficult to emulate. He described Dr Kalam as a man of ethos and values.

Later, the children were taken to visit the Museum at DRDO Bhawan, where the students took keen interest in the life and work of Dr Kalam depicted in the gallery. The function concluded with the recitation of National Anthem. ■

HOW DRDO IS KEEPING IAF MEN AND MATERIAL SAFE

ADRDE Seat Ejection Parachutes prove a boon for the IAF

State-of-the-art military equipment developed by Defence Research and Development Organisation's (DRDO's) Aerial Delivery Research and Development Establishment (ADRDE) like pilot seat ejection parachutes have once again proved their utility to the Indian Air Force when it mattered the most.

On 10 September, a MiG-21 fighter jet of the IAF that had taken off from Uttarlai Air Force Station, crashed near Barmer, Rajasthan. However, both pilots, using the Seat Ejection Parachute systems developed by ADRDE, ejected safely.

Two Types of Arrester Barriers Developed & Installed By ADRDE	
Developed	**Installed**
20 Ton Class	**42** System
40 Ton Class	**08** System

The Aircrew Seat Ejection Parachute Systems, which consist of a stabilizer and extractor parachute and main pilot parachute, provide an avenue of escape for the pilot from disabled aircraft both over land and water.

ADRDE has developed and substituted imported seat ejection parachute system for Russian Fighter Aircraft of the MIG series & SU-30 and for Western Aircraft like Jaguar, Mirage-2000 & Hawk.

On 20 September, a MiG-21 jet of the IAF overshot the runway at Srinagar Air Force Station. Once again, the pilots ejected out safely using ADRDE Seat Ejection Parachutes.

Not just the pilots, the Arrester Barrier System developed by ADRDE also saved the aircraft, in this incident which happened during a routine exercise. The Arrester Barrier System is installed at both ends of the runway and is used to stop the forward momentum of the Aircraft in case of an emergency during landing overrun or an aborted take-off.

ADRDE has developed two types of Arrester Barriers (20 Ton class and 40 Ton Class) and have installed 42 systems of 20 Ton class and eight of 40 Ton Class Arrester barriers at various Air Force stations.

ADRDE, Agra has been a pioneer in research and development where various capabilities related to design and development of parachutes, aerostat systems, aircraft arrester barrier systems and floatation systems for both military and civilian applications have been mastered over the years. ■

On 10 September, a MiG-21 crashed near Barmer, Rajasthan. Both pilots, using the Seat Ejection Parachute systems developed by ADRDE, ejected safely.

Seat Ejection Parachute

Aircraft Arrester Barrier System

ADM WARHEAD FOR PINAKA CLEARS TRIAL

DRDO's Armament Research & Development Establishment (ARDE), the nodal laboratory for design and development of PINAKA Multi Barrel Rocket System, conducted a series of user evaluation trials of one type of Area Denial Munition (ADM) warhead at Pokhran Field Firing Ranges.

The trials were conducted in two phases – for static performance at ARDE, Pune during 13-17 September and for dynamic performance at Pokhran during 26-30 September. The trials were jointly conducted by Army and Directorate General Quality Assurance.

As a part of user evaluation, ADM warhead rocket was test-fired for its lethality, functionality, accuracy and consistency at different ranges. Trials were extremely successful and all the mission objectives were met.

PINAKA, a Multi Barrel Rocket System, capable of neutralizing targets up to a range of 39 km, with different types of warheads, has been inducted in the Indian Army with two variants of warheads currently under production. This ADM warhead is capable of providing devastating effect on a variety of targets such as tanks, class B vehicles, mobile launchers, infantry formations etc.

Each warhead is capable of neutralizing an area of more than 10,000 square meters. Induction of this ADM Warhead into existing PINAKA system will boost the fire power.

The warhead is jointly designed and developed by two premier Pune-based DRDO laboratories namely, Armament Research and Development Establishment (ARDE) and High Energy Materials Research Laboratory (HEMRL).

The trial was witnessed by directors of both ARDE and HEMRL and also top officials from Army Headquarters. ■

BANG ON: NAG HITS BULL'S EYE IN FINAL DEVELOPMENTAL TRIALS

Successful Demonstration of capabilities of 'NAG' Missile System to the User (Indian Army)

NAG, the third generation, lock-on-before-launch (LOBL), fire-and-forget, anti-tank guided missile, indigenously developed by the Defence Research & Development Laboratory, Hyderabad under IGMDP, scored a "bull's eye" successfully hitting targets upto 4 km away in the final developmental trials held last month.

During the flight tests, held during 28-30 September, the Thermal Target System (TTS) was used as target for the missile. TTS simulated a target similar to an operational T-72 tank. For the flight test, a T-72 tank was moved for one hour and positioned at a range of 3.2 km. Thermal mapping from tank to TTS was carried out for generating thermal signature.

The TTS was used as target which was remotely controlled by RF system. The first missile was fired in the "worst time window" on 28 September. The missile hit the target precisely near turret location. A bull's eye hit was scored as confirmed by officials of the Indian Army present at the spot.

The second flight test was carried out with an objective of proving 4 km range capability of Infrared Imaging (IIR) Seeker. TTS was once again used as target and thermal mapping from a T-72 tank to TTS was carried out. The missile

THE DRDO WAY

- The NAG missile has been indigenously developed under the Integrated Guided Missile Development Programme (IGMDP).
- Four other missiles of DRDO - Agni, Akash, Trishul and Prithvi have also been developed under IGMDP.

hit the target bang on – this time on the engine location of the target.

Indigenous Thermal Target System (TTS) technology for 'NAG' developed by Defence Lab, Jodhpur, facilitates simulation of realistic tank target. TTS emanates IR Signature which is used as target during NAG Missile firing. TTS is well accomplished with remote control (RF Data Link) and closed loop control.

The developmental trials were conducted with an objective of proving higher range capability of High Resolution IIR Seeker.

'NAG' has 'Top attack' and 'Front Attack' capabilities. It is capable of defeating the heaviest type of armour including 'reactive' and 'composite' armour of the futuristic main battle tanks.

IIR Seeker of the Missile provides day & night operational capabilities against low silhouette tanks, both static and fast moving. The Single Shot Kill Probability (SSKP) of the missile is about 0.9.

NAG, which has been developed to support both mechanised infantry and airborne forces of the Indian Army, is designed to destroy modern main battle tanks and other heavily armoured targets. It can be launched from both land and air-based platforms.

Critical technologies indigenously developed for NAG Missile System include a high resolution IIR Seeker developed by RCI, Hyderabad. The performance of the Seeker is well established in guided flight tests of NAG. The trial validated the enhanced 4-km range capability of IIR seeker, which guides the missile to the target after its launch.

Operational target scenario presents mixed contrast of the target with respect to surrounding sand, shrubs and background clutter. IIR Seeker is capable of handling complex scenarios.

Efficient real-time image processing alogrithms and high end Onboard Integrated Electronics (INEL), which are part of IIR Seeker, have been developed by RCI, Hyderabad.

NAG Missile Carrier (NAMICA) is BMP2 based Infantry Combat Vehicle (ICV) suitably configured for firing 'NAG' Missile. NAMICA is an advanced system developed by DRDO.

Technologies for 'Tandem Warhead', 'Control System' and 'Solid Propulsion System' for NAG have been successfully developed by ARDE, Pune, RCI and ASL, Hyderabad.

NAG Missile Carrier (NAMICA) is BMP2 based Infantry Combat Vehicle (ICV) suitably configured for firing 'NAG' Missile. NAMICA is an advanced system developed by DRDO.

Independent Stabilized Sighting Systems for the Gunner and the Commander, Fire Control System, Launcher Platform, Drive System and Missile Operating Stations are the main subsystems of NAMICA.

The Commander's Panoramic Sight (CPS) is used by the Crew Commander for target surveillance and exploitation of Hunter-Killer capability. The Gunner Sight is used for target acquisition and missile firing. Six ready-to-fire 'NAG' Missiles can be mounted on the Launcher Platform. Amphibious trials & mobility trials have been successfully conducted by the Indian Army.

'NAG' Weapon System is ready for induction into Indian Army. ■

IN A NUTSHELL

THE NEWS

NAG, the third generation, lock-on-before-launch (LOBL), fire-and-forget anti-tank guided missile indigenously developed by the Defence Research & Development Laboratory, Hyderabad under IGMDP, scored a "bull's eye" successfully hitting targets up to 4 km away in the final developmental trials held last month.

USER'S TAKE

During the flight tests, held during 28-30 September, the Indian Army (THE USER) confirmed that the NAG missile hit the target bang on and on the engine location of the target.

WHAT NEXT

'NAG' Weapon System is ready for induction into Indian Army.

CHARACTERISTICS OF NAG MISSILE SYSTEM

- Lock-On-Before Launch (LOBL)
- Top Attack Capability
- Fire and Forget
- Deployed On BMP2 Based Tracked ICV

The missile hit the target precisely near turret location. A bull's eye hit was scored as confirmed by officials of the Indian Army present at the spot.

CUTTING EDGE INFRASTRUCTURE FACILITY: NMRL GETS CERAMIC DICING AND CUTTING MACHINE

A new Horizontal Computer Numeric Control (CNC) Ceramic Dicing and Cutting Machine has been acquired and set up at Naval Material Research Laboratory (NMRL) at Ambernath, Thane.

The equipment is designed for dicing and cutting of ceramic materials of hardness 10 GPa. This machine has the potential for designing and fabrication of 1-3 piezo composite prototypes for various applications of advanced futuristic sonar system like portable diver detection sonar, thin line towed array, acoustic imaging arrays, mine hunting sonar etc. ■

TECHNICAL FEATURES

- X,Y, Z Travel: 300mm x 300 mm x 200 mm
- Spindle Speed: 500 - 30000 rpm
- Depth of cut: 20 mm
- Positioning accuracy : 5 µm
- Rotational stage with advanced videoscopic alignment system
- Mechanical vice : 150 mm x150 mm
- Provision to use diamond cutting blades of OD 100 mm to 178mm
- CNC Compatible user friendly software with touchpad programming capability and real time display of important operational, diagnostic parameters & position co-ordinates
- Make: LOADPOINT U.K

DRDO CHIEF CALLS FOR INCREASED COLLABORATION BETWEEN ISSA AND SISTER DRDO LABS

Chairman Visits ISSA; Meets Key Officials

Dr S. Christopher, Secretary, Department of Defence Research & Development and Chairman, Defence Research and Development Organization (DRDO) has emphasised the need for the Institute for Systems Studies & Analyses (ISSA) to interact with sister DRDO labs for opportunities of collaborative work and incorporation of specific platform and weapon models.

Dr Christopher made the observation during his visit to ISSA on 28 August. He was accompanied by Shri G.S. Malik, CC R&D (R&M & Imp and SAM), Dr G. Athithan, DG (MED & CoS) and Shri M. H. Rahaman, CC R&D (HR & TM).

Demonstration of Land Activities at ISSA

The Chairman was given a detailed presentation by Shri S. B. Taneja, Director, ISSA followed by presentations by the project teams of Land Wargame, Naval Wargame, Air Wargame, Crisis Wargame and System & Operational Analysis Activities.

The Chairman appreciated the role and need of Systems Analyses, M&S in complete life cycle of product development including its employment and deployment and mission effectiveness in bigger context.

ISSA has grown into a nodal systems analysis laboratory of DRDO. It specializes in systems analysis, modeling & simulation of defence systems using state-of-the-art info-technologies such as Computer Networking, Software Engineering, Distributed Database, Distributed Simulation, Web Technologies, Situational Awareness, and Soft-Computing techniques in development of complex simulation products.

The visit concluded with tree plantation by Chairman DRDO. ■

NRB CHAIRMAN VISITS NAVAL MATERIALS RESEARCH LABORATORY, AMBERNATH

Naval Research Board (NRB) Chairman, Professor S.C. Misra along with Chairman, Materials Panel, and Professor Dhindaw visited Naval Materials Research Laboratory, Ambernath on 24 August. Dr S. B. Singh OS & Director, NMRL welcomed them and presentations on overview and activities of the laboratory were made.

A visit to all the departments was arranged and the Chairman and his team took keen interest on the various products and technologies of the laboratory. He also interacted with the scientists there and advised them to identify new research oriented areas for naval applications. ■

Chairman NRB taking keen interest in the products of NMRL

Interview of Chairman DRDO : Dr. S Christopher

'NEW TECHNOLOGY FUND FOR PRIVATE PLAYERS'

SECRETARY, Department of Defence Research and Development and director general, Defence Research and Development Organisation (DRDO) S. Christopher, divulges plans to encourage research among private sector players in defence production. He shares with *BW Businessworld's* Brij Pahwa, DRDO's plans to hand-hold industry in high-risk development tasks. Excerpts of the conversation:

S. Christopher, secretary, DDR&D and director general, DRDO

DRDO is a leading defence research organisation in the world. Is it a formidable legacy?

In the late 1970s, the nation took a deliberate decision that DRDO should grow from a small-scale weapon and equipment development organisation through reverse engineering, and venture into the indigenous design and development of large-scale military systems. This resulted in a paradigm shift in DRDO's approach from "Know How to Know Why". That was a renaissance of sorts in DRDO, as we started thinking big in the military context. The Integrated Guided Missile Development Programme (IGMDP), headed by A.P.J. Abdul Kalam, was the star of all the programmes during that period. Light combat aircraft (LCA), gas turbine engines, unmanned air vehicles (UAVs), electronic warfare (EW) systems, subsonic and supersonic cruise missiles, battle tanks, air defence radars, special materials, airborne surveillance systems, etc., followed in quick succession.

How do you see DRDO facilitating the Make in India initiative in the defence sector?

DRDO's mission mode projects are the pivot for the Make in India programme. The total production value of DRDO developed systems already inducted or approved for induction is more than Rs 2.1 lakh crore, which translates into four to five times the value in case of imported systems, excluding the strategic system and infrastructure developed by the DRDO. Many DRDO developed defence systems will make a huge impact on the Make in India programme, including LCA-Tejas, Akash, Pinaka weapon systems, electronic

warfare systems like Samudrika and Himshakti, various class of radars, advanced torpedo defence system — Maareech, the heavy-weight torpedo, Varunastra and the BrahMos missile.
The DRDO has also nurtured more than 1,000 MSME partners across the country. The positive vibes in the domestic market have opened up plenty of opportunities for exporting systems like the Akash missiles, AEW&C and BrahMos to friendly countries.

Will DRDO involve private industries as R&D partners in keeping with the Make In India drive?
Yes, the DRDO has also taken new initiatives to promote defence innovations in private industries, particularly MSMEs. I am happy to announce that DRDO has been entrusted to operationalize a Technology Development Fund (TDF) to encourage research through private industries and to hand-hold them in high-risk development tasks. Under this scheme, the industries will be involved in development activities in high-end technical areas to accelerate the production process without any burden of R&D cost. Even industries can get advance of a typical project cost of Rs 10 crore to meet the project requirements. The TDF released by DRDO in September 2016 is bound to encourage and enhance R&D activities in private industries. Apart from this we have also opened up the existing R&D infrastructure available in various DRDO laboratories for the private sector at nominal rates. These steps are going to be a big push for the Make in India programme in the defence sector.

Do you see the enhanced FDI limit in defence production as a challenge?
The enhancement of the FDI limit to 100 per cent in the defence sector can be viewed as another turning point in India's quest for self-reliance in arms production. For long, the industry and the business sector in India and abroad have been demanding unlimited access to foreign investments in the defence sector on the same lines as in other sectors.
For DRDO, this could mean a bigger opportunity to accelerate R&D in various technologically complex domains, as investments in defence production and specialised manufacturing facilities are expected to be scaled up exponentially, with more private partners joining the fray.

Indian security personnel work in extremely harsh environments. How does DRDO propose to ensure better work conditions for them?
Our laboratories strive hard to get to the core of the problems being faced by our troops in areas of counter insurgency operations, like high altitude areas, deserts, glaciated terrains and the Siachin. They are working on mitigation of problems of defence personnel operating in harsh environments of the country's border areas. More recently, DRDO inaugurated an Extreme Altitude Research Centre at Changla in Jammu and Kashmir at 17,600 feet above mean sea level, the world's highest terrestrial R&D centre. The centre will undertake research and development work in frontal areas of food and agriculture and bio-medical sciences for the well-being of soldiers deployed in high-altitude, cold, desert areas. This would definitely enhance the tactical efficiency of combat troops.

What initiatives has DRDO taken to promote academia partnership and innovations in defence manufacturing?
The DRDO Academia partnership is being pursued in project mode through four research boards in armaments, aero, naval and life sciences domains. But it was felt that these efforts were not enough and to make a stronger pitch with academia, DRDO has already created centres of excellence at various varsities, like IIT Madras, University of Hyderabad and Bharathiyar University, with targeted technology verticals.

The DRDO has recently signed MoUs with IITs for collaborative research, which includes establishment of a Centre of Excellence in Propulsion Technology (COPT) at IIT Bombay in July 2016 and setting up the Jagdish Chandra Bose Centre for Advanced Technology (JCBCAT) at Jadavpur University in June 2016.

"The total value of DRDO developed systems already inducted or slated for induction is more than Rs 2.1 lakh crore"

Courtesy: Business World

DRDO LABS PARTICIPATE IN NORTH TECH SYMPOSIUM

Fifteen DRDO labs participated in the North Tech Symposium organized by the Northern Command and exhibited over 150 products and technologies specifically suited for the Northern Command.

The Symposium, "Spectrum of Opportunities through tailor made technical solutions to facilitate Boots on Ground" was held during 7-8 September at Udhampur.

The Snow and Avalanche Study Establishment (SASE) participated in the symposium as the nodal laboratory for organising DRDO's participation in the event.

Lt Gen D S Hooda, UYSM, AVSM, VSM, GOC-in-C, Northern Command inaugurated the symposium. The theme for Day One was 'Tailor made Solutions for Soldier Readiness' in which about 82 different products were displayed by DRDO.

The thrust on Day Two was on 'Enhancing Combat Potential through Technology-based Solutions to meet Operational Challenges in Modern Warfare' in which DRDO displayed 75 different platforms and products including mini UAV's, Robotic platforms, Laser-based systems, Thermal Imaging Systems, Remotely Operated Vehicles and Mini Satellite Broadcast Receive Terminals. ■

Lt Gen DS Hooda, UYSM, AVSM, VSM, GOC-in-C, Northern Command interacting with DRDO Scientists during his visit to the NTS-2016 on 8 September 2016

DRDO'S DEFENCE SYSTEMS DRAW HUGE CROWD AT 9TH AFRICA AEROSPACE AND DEFENCE EXHIBITION

Defence Research and Development Organisation (DRDO), the country's premier military and research organization, participated in 9th Africa Aerospace and Defence Exhibition (AAD) – 2016 held at Waterkloof near Pretoria, South Africa during 14-18 September.

The Exhibition saw participation of 400 exhibitors from 30 countries.

DRDO showcased various defence products and technologies indigenously developed in India including Airborne Early Warning and Control System (AEW&C), Light Combat Aircraft - Tejas, AKASH surface-to-air guided missile, various ground/naval-based Radar systems including Aslesha, Bharani and Coastal Surveillance Radars, Low frequency Dunking SONAR, Advanced Heavy weight Torpedo (Varunastra), Advance Light weight Torpedo (TAL), Identification of friend or foe (IFF) interrogator, IFF Transponder and IFF-Combined interrogator and Transponder (CIT).

South African Defence Minister shows keen interest in DRDO Pavilion

DRDO's participation was also aimed at cultivating and enhancing export potential of these systems as there is a global demand for cutting-edge technology products.

Hon'ble Ms. Nosiviwe Noluthando Mapisa-Nqakula, Minister of Defence and military veterans of South Africa inaugurated the AAD-2016 exhibition and visited DRDO pavilion where she took keen interest in DRDO products, especially Akash Weapon System and AEW&C. ■

DRDO PAVILION BAGS 1st PRIZE AT IIF, 2016

DRDO Pavilion bagged 1st prize at India Industrial Fair held in Jaipur during 16-19 September where DRDO participated.

Among the major products displayed included Short Range Laser Dazzler, Tripod mounted Laser Dazzler, Pre-emptor, Optical Target Locator by LASTEC, e-Nasika by SSPL, thermal sensor & night vision device by IRDE, Bhukari by DIPAS, NBC suits, Tiffin for soldiers, Water bottle by DMSRDE and phase change material suit for soldiers in hot weather condition by DLJ.

An MSME conclave was also organised during the exhibition, which was inaugurated by the Hon'ble Chief Minister of Rajasthan, Smt. Vasundhara Raje on 17 September.

Shri Kalraj Mishra, Hon'ble Union Minister of MSME, was the first VIP to visit the DRDO pavilion. Shri Rajyavardhan Singh Rathore Hon'ble Union Minister of State for Information & Broadcasting also visited the DRDO pavilion and took keen interest in all DRDO products. ■


Shri Kalraj Mishra Hon'ble Union Minister of MSME Government of India


Shri Rajyavardhan Singh Rathore Hon'ble Union Minister of State for Information & Broadcasting

PROF HASNAIN HOLDS AUDIENCE SPELLBOUND AT BRIG SK MAZUMDAR MEMORIAL ORATION

Jamia Hamdard University's Vice Chancellor Professor Seyed Ehtesham Hasnain delivered the keynote address at the 28th Brig SK Mazumdar Memorial Oration on 21 September at the Institute of Nuclear Medicine and Allied Sciences (INMAS), Delhi. The oration was organized by INMAS in association with Brig S.K. Mazumdar Memorial Trust.

Prof Hasnain spoke about the extra-ordinary intelligence of the mycobacterium that causes tuberculosis (TB) and made an outstanding description of the global scenario of TB.

Dr Manas K Mandal, DS and DG Life Sciences at DRDO presided over the function. Dr A.K. Singh, Chairman Brig S.K. Mazumdar Memorial Trust and OS & Director INMAS welcomed the guests.

Dr Mandal in his presidential address suggested that DRDO scientists and the medical fraternity follow the path shown by Brig Mazumdar to develop technologies for the benefit of Indian soldiers. The Trust also awarded the Brig Mazumdar Young Scientist Award for the year 2015 to Dr Jayanth Daniel, Sc E, DEBEL & year 2016 award to Dr Amit Kumar, Sc D, INMAS. ■

CORPORATE REVIEW MEETINGS

DRL, TEZPUR ON 17 SEPTEMBER

The meeting was chaired by Dr Manas K. Mandal, DS & DG (LS). Dr P.S. Raju, Director, DRL gave a presentation on the status of the ongoing projects, future plan of action and issues related to HR, works, finance, etc.

The meeting was attended by Smt Nabanita R Krishnan, Director, DP&C, Dr Hina A. Gokhale, Director, DOP, Shri Ashok Kumar, Director, DHRD, Shri Alok Mall, Additional Director, DOP, Shri M.P. Gupta, Additional Director, DBF&A, Col M. Sisodia, CCE R&D (East) Rep and scientists of the laboratory. ■

ISSA, DELHI ON 24 AUGUST

The review was chaired by Shri M H Rahman, DS & CC R&D (HR). Other review committee members included Smt Nabanita R Krishnan, Director DP&C, Dr Hina A Gokhale, Director DOP, Shri Ashok Kumar, Director HRD, Rep DBF&A, Rep DOP, Rep DMM and Rep DCW&E. Senior officers of ISSA including technology heads and group heads attended the meeting. The Corporate Committee also interacted with the young scientists, reps of DRTC, admin & allied cadre. Issues and concerns of the corporate office, lab and various cadres were discussed and the way ahead was decided. ■

MRTDD FACILITY TO BE ESTABLISHED AT ZIRCONIUM COMPLEX, TUTICORIN, TAMIL NADU

The Zirconium Complex in Tuticorin will house a pilot project for Magnesium Recycling Technology Development & Demonstration Facility (MRTDDF).

The technology has been developed by Defence Metallurgical Research Laboratory (DMRL) and the project will be jointly implemented by Zirconium Complex, Tuticorin, Heavy Water Plant (HWP), Tuticorin and DMRL, Hyderabad with funding provided by NFC, Hyderabad.

Dr Samir V Kamat, OS & Director, DMRL at the foundation stone laying ceremony of MRTDDF

The foundation stone laying ceremony for the facility was held on 17 August in the presence of Director, DMRL, Chief Executive, NFC and Chief Executive, Heavy Water Board at ZC, Pazhayakayal. The facility is expected to commence R&D operations in about two year's time.

DMRL has carried out industrial scale R&D on fused salt electrolysis of anhydrous magnesium chloride (generated as a by-product in the production of titanium/ zirconium sponge) employing both monopolar and mutlipolar cells.

On recommendation of National Committee on Magnesium, the activity is being taken forward by Department of Atomic Energy (DAE) to fine tune the technology for enabling industrial implementation of the same.■

DRDO CHAIRMAN AWARDED NATIONAL AERONAUTICAL PRIZE

The National Aeronautical Award for the year 2015 has been awarded to Dr S. Christopher, Secretary, Department of Defence (R&D) & Chairman DRDO in recognition of his successful generation of unavailable & critical technologies like Transmit-Receive Multi-Module (TRMM), Active Electronically Scanning Array (AESA) & structurally integral, ultra light 'Teflon-Clad Active Array Antenna Panels' for AEW & C system.

Hon'ble Union Minister of Civil Aviation Shri Ashok Gajpati Raju gave the award to Dr Christopher on the occasion of the 67th AGM of The Aeronautical Society of India held at IIT Mumbai on 14 October. The award was jointly given to him & Shri N.K.Gupta, former Dy. Director & Project Director (Cryogenic), ISRO. ■

GITAM UNIVERSITY CONFERS HONORARY DOCTORATE TO DRDO CHIEF DR S CHRISTOPHER

Dr S Christopher, Secretary, Department of Defence Research and Development and Chairman, DRDO was awarded the Honorary Degree of Doctor of Science at the 7th convocation ceremony of the GITAM University in Hyderabad on 17 September.

Prof Y Prabhavati in his citation address described Dr Christopher as a rare blend of "innovation, competence, social concern and national spirit with overflowing kindness and warmth at heart". ■

BLOOD DONATION CAMPS

Mega blood donation camps were organised at ITR Chandipur and DEAL Dehradun on 31 August and 16 September respectively. Both blood donation camps saw an enthusiastic response from employees. ■

RAISING DAY CELEBRATIONS

SASE

Snow and Avalanche Study Establishment (SASE) celebrated its 48th Raising Day at HQ Manali and RDC Chandigarh on 1 October with great zeal and enthusiasm. Shri Ashwagosha Ganju, Director SASE presented a brief account of the achievements of the laboratory during the year and its future objectives. Various laboratory level DRDO Awards were distributed to DRDS, DRTC, Admin and Allied category personnel for meritorious work during the year. Sports and cultural events were also organised to celebrate the occasion. In the evening, a colourful cultural programme was presented by the employees and their family members. ■

DIPAS

The Defence Institute of Physiology and Allied Sciences (DIPAS), Delhi, celebrated its 55th Raising Day on 27 September.

Dr G Satheesh Reddy, DS, SA to RM and DG (MSS), DRDO, was the Chief Guest on the occasion and Dr Manas K Mandal, DS & DG (LS), was the Guest of Honour.

Various sports events like carrom, chess, cricket, three leg race, musical chair and tambola were organised and large number of DIPAS employees participated in these events. The winners in different categories were rewarded for their efforts. Former employees of DIPAS also attended the function. The day ended with a cultural event. ■

BOOKS AND PUBLICATIONS

RCI, Hyderabad organised a book release event on 23 September, 2016 where BHVS Narayana Murthy, OS & Director RCI was the Chief Guest. He released the Text Book on "Applied Impact Mechanics" Authored by Prof C. Lakshmana Rao, IIT Madras.

Dr N. Vjaya Bhaskar, Sc-E, RCI alongwith Prof KRY Simha, IISc Bangalore covered important features of the book and areas of applications of impact mechanics.

Prof C. Lakshana Rao delivered a lecture on purpose of Applied Impact Mechanics and Prof KRY Simha delivered a lecture on Impact Mechanics for Engineering Design & Analysis and role of Applied Mechanics in Biology and Sports. ■

Dr Jubilee Purkayastha, Scientist-D, in the Office of the Director General (Life Sciences), has published a book entitled "Bioprospecting of Indigenous Bioresources of North-East India" Editors: Purkayastha, Jubilee (Ed.). The work is a comprehensive information on the indigenous bioresources of North Eastern India with the scope of bioprospecting for discovery and commercialisation of new sources and products and long-term ecological balance. This book offers ample information about various levels of bioprospecting of the gene pool of this Indo-Burma Mega Biodiversity Hot Spot, the North East India, which is endowed with huge biodiversity potential for exploration and exploitation for the benefit of humankind. ■

HINDI PAKHWADA 2016

DEFENCE INSTITUTE OF HIGH ALTITUDE RESEARCH, LEH CELEBRATES HINDI PAKHWADA 2016

The Defence Institute of High Altitude Research, Leh, celebrated Hindi Pakhwada during 14-28 September at DIHAR HQ, Leh and its detachments at Partapur and Base Lab, Chandigarh to spread awareness about the Rajbhasha among employees. A number of competitions were organized on this occasion.

Brigadier Rajiv Thakur, SM, Dy GOC, 3 Infantry Division, was the Chief Guest for the Opening Ceremony. Director DIHAR, Dr Bhuvnesh Kumar and Official Languages Officer, Dr Narendra Singh, Sc 'F' were also present during the occasion.■

HINDI FORTNIGHT CEREMONY AT PXE, CHANDIPUR

The Proof & Experimental Establishment, Chandipur celebrated the Hindi Fortnight Ceremony during 5-20 September. The Ceremony was inaugurated by OS & Director, R Appavuraj. All employees along with Director took oath in Hindi. Competitions such as Hindi Quiz with the questions related to Art, Science, Sports, Politics, History etc. were organized. Events related to Hindi Speech writing, poem recitation, debates, translation essay writing, dictation were also organized. In the Valedictory Function, messages of Home Minister, Defence Minister & Chairman DRDO were read out. A special issue of "Kuchh Khatta Kuchh Mitha" was released by the Officiating Director Shri T K Biswal. ■

DFRL MYSORE CELEBRATES HINDI FORTNIGHT

The Defence Food Research Laboratory (DFRL), Mysore celebrated the Hindi Pakhwada during 1-15 September.

The Valedictory Function was celebrated on 15 September in which Dr. V. Shivaprasad, Director, Central Sericulture Research and Training Institute (CSRTI), Mysore was the Chief Guest. Dr. R. K. Sharma, Scientist 'G' Director, DFRL presided over the function while Dr. G. K. Sharma, Scientist 'G' Associate Director & Hindi Liaison officer, DFRL welcomed the gathering.■

HINDI DAY CELEBRATIONS AT RCI, HYDERABAD

Research Centre Imarat (RCI), Hyderabad organized Hindi Day on 26 September, 2016. Senior Hindi Translator, RCI, Shri Kazim Ahmed gave the welcome address.

Shri T. Narasimha Rao, Sc'G', DOMS, Vice Chairman OLIC appreciated the efforts of Hindi cell in all areas of work. Shri BHVS Narayana Murthy, OS & Director RCI was the Chief Guest. In his address, Shri Rao stressed on effective implementation of Hindi both at Management & Project levels.■

DRDO HARNESSING SCIENCE FOR PEACE AND SECURITY- IX

CHAPTER 1: THE BEGINNING - DEFENCE SCIENCE

The article is Ninth in the Series of extracts of the monograph, "Defence Research & Development Organisation: 1958-1982", by Shri RP Shenoy, former Director of Electronics and Radar Development Establishment (LRDE).

Dr Kothari as Scientific Adviser – Some Vignettes

Dr Kothari aimed to build what is now known as a boundary less, learning organisation, stripped of hierarchical trappings and with two-way communication between him and his scientists. Almost all the scientists who had been associated with Dr Kothari in the early days of the organisation and who were available to the author for discussions, have provided more than one example of interaction with Dr Kothari, which bring out these aspects. The constraints of space do not allow the author to spell out all of them.

Mr CP De, who had a long tenure as the Director of Naval, Chemical and Metallurgical Laboratory (now renamed as Naval Material Research Laboratory), Mumbai, and who joined as a junior scientist and was placed in Mumbai for research in problems related to the Indian Navy, recalled with great affection the time Dr Kothari spent in his single room bachelor's quarters at the YMCA in Mumbai. Whenever the Scientific Adviser came to Mumbai from Delhi, he would go to De's room, take rest in his lodgings, have tea with him like any family member, would take the young scientist with him to meet eminent personalities, such as Dr Bhabha. In this way, the young scientist came to know some of the top intellects of the country and this stood him in good stead not only in his scientific pursuits but also in building the NCML and interacting with senior officers of the Indian Navy. Mr De also recalled the manner in which Dr Kothari made the young scientists get into the habit of reading contemporary scientific journals and derive the benefits. It was the Scientific Adviser's practice to send a note to a young scientist like him stating "please speak" and enclosed with it there would be an extract of an article from a scientific journal, or a report or experimental data pertaining either to his specialisation or to the problem the young scientist was working on. Mr De would read not only in depth as well as in breadth because he could expect a call from the Scientific Adviser for an in-depth discussion, and wide ranging probing at the end of which if he had prepared well, he would come out with a feeling of having gained by the discussion and with an urge to do even better next time.

Mr SL Bansal, who retired as a Distinguished Scientist of the DRDO, attributed that whatever he had achieved in the organisation was due to the initial training and advice he got from Dr Kothari. He reminisced that he could go and meet Dr Kothari at the Delhi University whenever he had some doubts or queries to be put to the Scientific Adviser. The Scientific Adviser would then find time and walk with him on the University grounds and with patience, clear his doubts as he would have done for a younger member of his own family. He told about one occasion when he queried the Scientific Adviser about his attending interview boards for the selection of young scientists for the Organisation. Dr Kothari, in his characteristic way explained that just as pillars are crucial structures for an edifice, he considered the calibre of the scientists recruited for the Defence Science Organisation to be a crucial factor for its efficacy and growth. Dr Kothari's reply made young Bansal realise how great a responsibility each one of them carried in ensuring the future of the organisation. Consequently in all his endeavours, he tried to live up to the expectations of Dr Kothari. On another occasion, Dr Kothari asked him to be his representative in a meeting called by a senior Army officer in his area of work. The young scientist felt honoured that he has been asked to attend such an important meeting and prepared himself well. When he went to attend the meeting, the Army Brigadier who was chairing the meeting on learning that he represented the Scientific Adviser got up from the chair, welcomed him and gave him a very respectful hearing. That Dr Kothari commanded respect from the

Services for his intellectual ability was brought home to him and it also firmed his resolve to master the subject.

Dr H Nath, a food and nutrition expert, who retired as Director of Life Sciences, and who at 30 was the youngest Senior Scientist recruited by Dr Kothari, recalled with a sense of nostalgia, two incidents in his early interaction with the Scientific Adviser. In the first one, when he joined the Organisation, Dr Kothari put him at ease first in his characteristic way and then informed him that he being the youngest of the Senior Scientists, he would form the core group and also that he would have to take additional responsibilities such as the editorship of the Defence Science Journal and also represent him in the Materials Group formed for advising the Technical Development Establishment at Kanpur. Dr Nath felt elated as well as honoured that he was singled out for shouldering additional responsibility and he resolved to work harder so that the Scientific Adviser would not feel let down by him. On another occasion, he queried the Scientific Adviser why he preferred to designate his colleagues in the Defence Science Organisation as Scientists instead of the normal designation, Scientific Officers. Dr Kothari took time to explain to his junior colleague in his own way the reasons behind it. Dr Kothari said that as understood in the country, the job of an Officer in Government service is restricted to the normal office working hours, whereas he wanted to convey to all of his colleagues that he expected them to think about their work all the time as any true scientist would do. Hence, he stated that he preferred the designation Scientist to Scientific Officer.

Dr SS Ramaswamy, a physiologist who joined the Defence Science Organisation in 1950 and who later on retired as a member of the Atomic Energy Regulatory Board, had no hesitation in stating that the scientific temper and culture that Dr Kothari tried to instill in him and in other scientists in the organisation was a great asset that helped him throughout his professional life and he is grateful to Dr Kothari for this. He recounted how Professor Kothari, in spite of being a pure theoretical physicist, mastered in a very short time the essentials of the multi- discipline aspects of defence science and was able to guide and direct the scientists on which aspects that they should undertake work in their areas of specialisation. On joining the organisation young Ramaswamy queried Dr Kothari about the work he could undertake in the absence of laboratory facilities. Dr Kothari in his gentle ways pointed out to him that as a scientist, his greatest asset was his thinking capacity and that lack of facilities should not hold him back from taking up work. He suggested to Ramaswamy that in view of his training in physiology and as soldiers do a lot of walking and running, he should take up studies on the relationship of such parameters as the speed of walking, length of stride, energy consumption, and so on, in the mechanics of walking. On another occasion, after the Physiology group had moved to Jodhpur, and Dr Kothari was about to visit their unit, he was asked by his senior to make arrangements for the overnight stay of the Scientific Adviser in the laboratory premises. Even though he was advised that he leave a few books/magazines of light reading for the Scientific Adviser to glance through before retiring to bed, Dr Ramaswamy left at his bedside table, a batch of newly received reports from the Food and Nutrition Laboratory of the US Army in the hope that it might interest the Scientific Adviser. To the surprise of the young scientist when he met Dr Kothari in the morning, the latter commended him for his thoughtfulness in leaving the reports at his bedside and stated that the subject matter of the reports would form the topic of his address that morning. Dr Ramsawamy recalled with a sense of awe, the way that Dr Kothari grasped the essentials in a totally different area in such a short time and presented it cogently and succinctly to the audience without losing their attention. ■

PERSONNEL NEWS

AWARD WINNER K RAMBABU PROMOTED

K. Rambabu, Sc 'G', RCI has been promoted as Sc 'H' with effect from 20, September 2016. He joined IRDE, Dehradun as Sc 'B' in 1983 and subsequently served in DRDL and RCI. K Rambabu is a recipient of DRDO's Agni Award for Excellence in Self-Reliance 2002. ■

QUOTABLE QUOTE

"Look at the sky. We are not alone. The whole universe is friendly to us and conspires only to give the best to those who dream and work."

- Dr APJ Abdul Kalam

NEW ACCOUNTS OFFICE AT DRL, TEZPUR

The new accounts office (R&D) in the premise of DRL, Tezpur was inaugurated by Shri Upendra Sah, IDAS, PCDA (R&D) on 6 September. Shri Sah, in his inaugural address, said the pending demand of the laboratory had been fulfilled and the office will cater to the needs of the officers and staff. On this occasion, Dr PS Raju, Director DRL delivered welcome address highlighting the achievements of the laboratory. ■

CAPSULE COURSE FOR AIR FORCE PERSONNEL AT DRDE, GWALIOR

A special five-day CBRN Capsule Course for Indian Air Force personnel was organised at Defence Research & Development Establishment (DRDE), Gwalior during 5-9 September.

Twenty six officers and air warriors from different wings of Indian Air Force participated in the course, which covered topics ranging from detection, protection, decontamination, threat perceptions and counter measures for chemical and biological warfare agents. Senior faculty members and experts in the relevant fields delivered the lectures. Dr A. K. Goel, Sc 'F' was the Course Director. Dr Lokendra Singh, OS & Director, DRDE distributed the certificates. ■

DRDE Faculty and participants from Indian Air Force Services during the Course

MILITARY OPERATIONS COURSE AT ITM, MUSSOORIE

ISSA, Delhi organised a special course on Military Operations & Tactics for Systems Analyses at Institute of Technology Management, DRDO, Mussoorie during 25-29 July.

ITM was established in 1962. The core mandate of the Institute is to organise and impart state-of-the-art training in areas related to techno-managerial aspects of handling programs and projects in the organisation.

The course on Military Operations & Tactics for Systems Analyses was designed to give insight into operations & tactics of tri-services followed by systems analyses, modeling & simulation and war gaming aspects handled at ISSA. 24 participants attended the course.

The invited faculty delivered the talk on introduction to organization, role, operations and tactics of respective services. ■

ADMINISTRATIVE MANAGEMENT COURSE AT PXE

The Proof & Experimental Establishment, Chandipur organised a training course on Administrative Management with Creativity for administrative staff and officers during 8-12 August.

Topics like Common problems faced by Lab Administrative personnel, Innovative and Creative Thinking, Attitudinal role in successful Proactive Administration, Creativity and its importance in decision making, e-governance in administration, Ethics in Administrative Management, Role of a leader in success of team activities, Temporary Duty entitlement, Rules on availing LTC in Central Government Service, Service Book and Documentation – Role and their maintenance, National Pension System, Leave rules and different case studies, Role of empathy on problem solving etc., were dealt by expert faculties. ■

ORGANISATION OF CEP ON "OPTICAL TRACKING FOR EVALUATION OF WEAPON SYSTEM" AT ITR, CHANDIPUR

A CEP course on "Optical Tracking for evaluation of Weapon System" was organized at ITR, Chandipur during 29 August to 02 September 2016.

Dr B.K. Das, Outstanding Scientist and Director, ITR inaugurated the course. Dr D R M Samudraiah, ISRO, Ahmedabad was the chief guest in the inaugural programme.

The course aimed to update the knowledge of the participants on the latest trends of optical tracking. Various topics related to Optical Tracking were covered during the course. Distinguished faculties and experts from ISRO, Ahemedabad, IRDE, Dehradun, IIT Kharagpur and ITR Chandipur delivered the lectures. ■

Defence Research & Development Organisation

DRDO pays tribute to

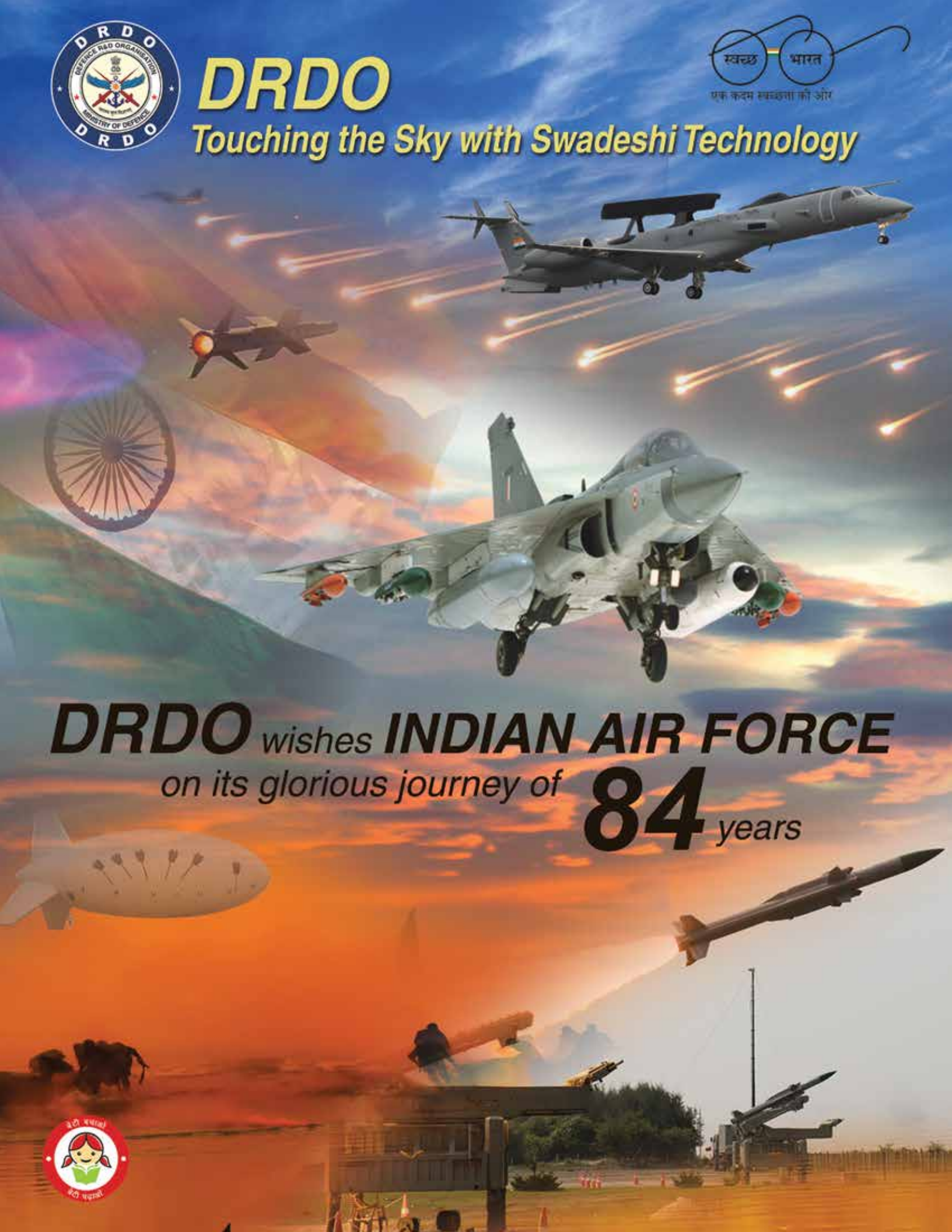
Dr APJ Abdul Kalam

(1931 - 2015)

on the occasion of his 85th Birth Anniversary

15th October 2016

You remain our inspiration...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Touching the Sky with Swadeshi Technology
स्वच्छ भारत
एक कदम स्वच्छता की ओर
DRDO wishes INDIAN AIR FORCE
on its glorious journey of 84 years